Si-Based Lab-on-A-Chip Integrated Photonic Spectrometer, Phase I



Completed Technology Project (2018 - 2019)

Project Introduction

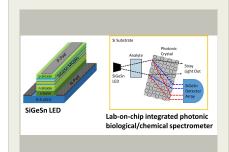
In this STTR Phase I program, Structured Materials Industries, Inc. (SMI) and Arizona State University (ASU) will develop a SiGeSn based light emitter device technology on Si, which will be a key ingredient for Si-based integrated photonics applications, such as in lab-on-a-chip integrated chemical and biological spectrometers for landers, astronaut health monitoring, front-end and back-end for remote sensing instruments including trace gas lidars in NASA missions. SiGeSn presents a great potential for the Si-based photonic spectrometers since it offers a direct band gap over a range of compositions as well as direct growth compatibility with Si. The narrow direct band gap offers the promise of III-V like photonic device performance in the ~ 1.5 to 5.0 micron range.

The proposed on-chip biological and chemical spectrometer on silicon has the distinctive advantages of small foot print, potentially fully integrated on the same silicon platform to form the SI phonic circuits, including SiGeSn LED light source and detector, as well as light dispersion function, that will be made of a photonic crystal, rather than a diffraction grating as a means of wavelength separation. The full integration of SiGeSn emitters with photonic devices, all on Si, will constitute the long awaited dawn of the next generation in semiconductor electronics-photonics and spectrometers on one common platform.

Anticipated Benefits

The development of efficient Si-based emitters compatible with Si is the holy grail of integrating photonic biological/chemical spectrometers. The end result will be the development of a very critical element of high performance compact lab-on-chip spectrometer for biological/chemical investigations for NASA missions.

The public benefits of Si-based emitters are in medical instruments, medical diagnostics, energy management, military systems, general computing, games, automation, or any of all the electronic devices we use. The benefit will be improved performance, improved living standards, more efficient operation of instruments and so forth.



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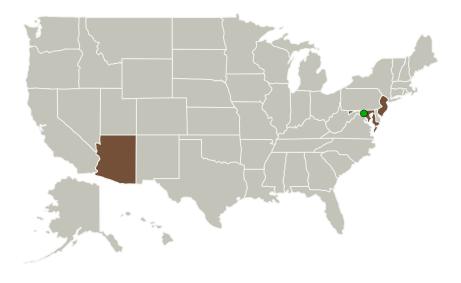


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Primary U.S. Work Locations and Key Partners



| Organizations Performing Work | Role | Туре | Location |
|---------------------------------------|----------------------|----------|---------------------------|
| Structured Materials Industries, Inc. | Lead Organization | Industry | Piscataway, New Jersey |
| Arizona State | Supporting | Academia | Tempe, |
| University-Tempe(ASU) | Organization | | Arizona |
| Goddard Space | Supporting | NASA | Greenbelt, |
| Flight Center(GSFC) | Organization | Center | Maryland |

| Primary U.S. Work Locations | | |
|-----------------------------|----------|--|
| Arizona | Maryland | |
| New Jersey | | |

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Structured Materials Industries, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

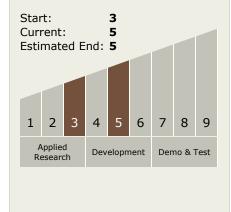
Program Manager:

Carlos Torrez

Principal Investigator:

Arul Arjunan

Technology Maturity (TRL)





Small Business Innovation Research/Small Business Tech Transfer

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Project Transitions



July 2018: Project Start

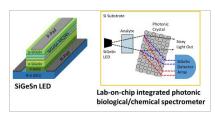


August 2019: Closed out

Closeout Documentation:

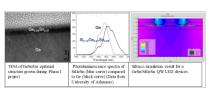
• Final Summary Chart(https://techport.nasa.gov/file/137903)

Images



Briefing Chart Image

Si-Based Lab-on-A-Chip Integrated Photonic Spectrometer, Phase I (https://techport.nasa.gov/imag e/136223)



Final Summary Chart Image

Si-Based Lab-on-A-Chip Integrated Photonic Spectrometer, Phase I (https://techport.nasa.gov/imag e/134902)

Technology Areas

Primary:

- TX08 Sensors and Instruments
 - ☐ TX08.1 Remote Sensing Instruments/Sensors
 - ☐ TX08.1.1 Detectors and Focal Planes

Target Destinations

The Moon, Mars, Others Inside the Solar System

